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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ZERVIGON, RUDY	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 11/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/864,376	OHMI ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 September 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,12-14 and 16-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,12-14 and 16-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-5, 7, 8, 9, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (USPat. 5,861,601) in view of Otsubo et al (USPat. 4,985,109). Sato teaches a plasma processing apparatus (Figure 2) including:

i. A processing chamber (3, Figure 2)

ii. A microwave (6, Figure 2) slot radiating antenna / radiating surface (41, Figure 2; column 9, lines 6-30)

iii. A plate-shaped dielectric body (4, Figure 2; column 4, lines 25-35)

iv. A distance "D" between the microwave radiating antenna surface (41, Figure 2; column 9, lines 6-30) and a surface of the dielectric body (4, Figure 2; column 4, lines 25-35) is shown by Sato et al in Figure 2

v. Sato et al teaches a dielectric plate as discussed above

vi. Sato further teaches the plasma (column 3; lines 58-67) is formed between the plasma exciting surface (4; Figure 2 – the lower surface of the dielectric body) and the object (10; Figure 2) to be processed – claim 1

Sato does not teach a specific thickness "d" for his dielectric plate. Sato does not teach a slot antenna where a part of the number of slots is closed. Sato does not teach forming a standing wave microwave between his microwave radiating surface (41; Figure 2) and his plasma exciting surface (4; Figure 2 – the lower surface of the dielectric body). Sato further does not teach

relative spacing (Applicant's "D") between Sato's plate-shaped dielectric body (4, Figure 2; column 4, lines 25-35) and Sato's plasma radiating surface (41; Figure 2).

Otsubo teaches a concentric slot antenna (Figure 2) in a microwave plasma reactor (Figure 1) having a number of slots (5a) formed and distributed in the microwave radiating surface where a part of the number of slots can be closed (column 7, lines 3-15). Otsubo further teaches a standing wave (column 19, lines 31-37) microwave between his microwave radiating surface (5; Figure 13) and his plasma exciting surface (4; Figure 13 – the lower surface of the quartz plate) – "...the standing wave of the microwaves is generated between the slot plate 5 and the stage 7 ". Otsubo further teaches identical means (5, 5a, 4; Figures 1,2; column 7, lines 3-15; column 19, lines 31-37) to delimit propagation of Otsubo's standing waves as taught by Applicant's specification (page 19, lines 14-23):

"

That is, for the purpose of forming a favorable standing wave in the region between the lower surface of the radial line slot antenna 6 and the plasma exciting surface to generate a high density plasma in the processing cavity 3, the distance D between the lower surface of the radial line slot antenna 6 and the lower surface the dielectric plate which represented with the wavelength of the microwave being a distance unit , has only to satisfy the inequality

$0.7n/4 \leqq D \leqq 1.3n/4$ (n being a natural number).

"

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Sato to optimize the thickness of the dielectric plate, and for Sato to use Otsubo's slot antenna during standing wave microwave propagation.

Motivation for Sato to optimize the thickness of the dielectric plate is for optimizing the space "between the slot antenna and the quartz window 4 through which the microwaves pass so that the microwaves emitted from the slot antenna have room to expand" (column 9, lines 6-30) as taught by Otsubo, further, motivation for Sato to use Otsubo's slot antenna under standing wave microwave propagation is for "easy" plasma generation as taught by Otsubo (column 19, lines 35-40).

3. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (USPat. 5,861,601) and Otsubo et al (USPat. 4,985,109) in view of Tsuchihashi, Masaaki et al (USPat. 6,109,208). Sato and Otsubo are discussed above. Sato and Otsubo do not teach plural slots of the microwave radiating antenna where the plural slots in the peripheral direction are closed. Tsuchihashi teaches a similar microwave plasma generating device (Figure 20, 21; column 11, lines 37-49) including plural slots ("slits" 6a-d, 10a-d) in the peripheral direction of the shutter antenna (26) where portions of the slots ("slits" 6a-d) in the peripheral direction can be opened ("A" direction; Figure 20) or closed (counter to "A" direction; Figure 20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Sato and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna where portions of the slots in the peripheral direction can be opened or closed as taught by Tsuchihashi, and for Sato to optimize the thickness of the dielectric plate.

Motivation to replace Sato and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna where portions of the slots in the peripheral direction can be opened or closed as taught by Tsuchihashi is for distributing microwaves as taught by Tsuchihashi (column 11, lines 37-49), further, motivation for Sato to optimize the thickness of the dielectric plate is for optimizing the

space "between the slot antenna and the quartz window 4 through which the microwaves pass so that the microwaves emitted from the slot antenna have room to expand" (column 9, lines 6-30)

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (USPat. 5,861,601) and Otsubo et al (USPat. 4,985,109) in view of Tsuchihashi, Masaaki et al (USPat. 6,109,208). Sato and Otsubo are discussed above. Sato and Otsubo do not teach plural slots of the microwave radiating antenna where the plural slots in the peripheral direction are closed.

Tsuchihashi teaches a similar microwave plasma generating device (Figure 20, 21; column 11, lines 37-49) including plural slots ("slits" 6a-d, 10a-d) in the peripheral direction of the shutter antenna (26) where portions of the slots ("slits" 6a-d) in the peripheral direction can be opened ("A" direction; Figure 20) or closed (counter to "A" direction; Figure 20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Sato and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna where portions of the slots in the peripheral direction can be opened or closed as taught by Tsuchihashi.

Motivation to replace Sato and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna where portions of the slots in the peripheral direction can be opened or closed as taught by Tsuchihashi is for distributing microwaves as taught by Tsuchihashi (column 11, lines 37-49).

5. Claims 16-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (USPat. 5,861,601) in view of Otsubo et al (USPat. 4,985,109). Sato is discussed above. Sato further teaches a plasma processing apparatus (Figure 2) including a microwave (6, Figure 2) radial line (41; Figure 3) slot radiating antenna / radiating surface (41, Figure 2; column 9, lines 6-30)

Sato does not teach a specific thickness "d" for his dielectric plate. Sato does not teach a slot antenna where a part of the number of slots is closed. Sato does not teach forming a standing wave microwave between his microwave radiating surface (41; Figure 2) and his plasma exciting surface (4; Figure 2 – the lower surface of the dielectric body). Sato further does not teach relative spacing (Applicant's "D") between Sato's plate-shaped dielectric body (4, Figure 2; column 4, lines 25-35) and Sato's plasma radiating surface (41; Figure 2).

Otsubo teaches a slot antenna (Figure 2) in a microwave plasma reactor (Figure 1) having a number of slots (5a) formed and distributed in the microwave radiating surface where a part of the number of slots can be closed (column 7, lines 3-15). Otsubo further teaches a standing wave (column 19, lines 31-37) microwave between his microwave radiating surface (5; Figure 13) and his plasma exciting surface (4; Figure 13 – the lower surface of the quartz plate) – "...the standing wave of the microwaves is generated between the slot plate 5 and the stage 7 ".

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Sato to optimize the thickness of the dielectric plate, and for Sato to use Otsubo's slot antenna, with Sato's radial line slot configuration, during standing wave microwave propagation. Motivation for Sato to optimize the thickness of the dielectric plate is for optimizing the space "between the slot antenna and the quartz window 4 through which the microwaves pass so that the microwaves emitted from the slot antenna have room to expand" (column 9, lines 6-30) as taught by Otsubo, further, motivation for Sato to use Otsubo's slot antenna, with Sato's radial line slot configuration, under standing wave microwave propagation is for "easy" plasma generation as taught by Otsubo (column 19, lines 35-40) and circular TE_1 microwave generation for uniform and high density plasmas as taught by Sato (column 9, lines 7-30) .

Response to Arguments

6. Applicant's arguments filed September 8, 2004 have been fully considered but they are not persuasive.

7. Applicant states that Otsubo does not teach "a standing wave of a microwave is formed between the microwave radiating surface of the antenna and a lower surface of a quartz plate by determining the distance there between based on the wavelength of the microwave, as defined by the claimed invention." because the Examiner used the term "delimit propagation". It is reasserted by the Examiner that Otsubo's capacity to establish a standing wave is very well established according to Otsubo:

"Otsubo further teaches a standing wave (column 19, lines 31-37) microwave between his microwave radiating surface (5; Figure 13) and his plasma exciting surface (4; Figure 13 – the lower surface of the quartz plate) – "...the standing wave of the microwaves is generated between the slot plate 5 and the stage 7 "." That Otsubo is silent with respect to the relative positions and/or thickness of Otsubo's microwave radiating surface (5; Figure 13) and his plasma exciting surface (4; Figure 13 – the lower surface of the quartz plate) based on the wavelength of the microwave is recognized. However, the Examiner believes that said relative positions and/or thickness of Otsubo's microwave radiating surface and Otsubo's plasma exciting surface that sustain Otsubo's standing wave is an optimizable quantity as taught by Otsubo: Motivation for Sato to optimize the thickness of the dielectric plate is for optimizing the space "between the slot antenna and the quartz window 4 through which the microwaves pass so that the microwaves emitted from the slot antenna have room to expand" (column 9, lines 6-30) as taught by Otsubo".

It was cited that Otsubo teaches identical means (5, 5a, 4; Figures 1,2; column 7, lines 3-15; column 19, lines 31-37) to delimit propagation of Otsubo's standing waves including the capability that Otsubo's standing waves not enter Otsubo's plasma. Specifically, Applicant accomplishes said task as stated by Applicant's specification (page 19, lines 14-23):

"

That is, for the purpose of forming a favorable standing wave in the region between the lower surface of the radial line slot antenna 6 and the plasma exciting surface to generate a high density plasma in the processing cavity 3, the distance D between the lower surface of the radial line slot antenna 6 and the lower surface the dielectric plate which represented with the wavelength of the microwave being a distance unit , has only to satisfy the inequality $0.7n/4 \leq D \leq 1.3n/4$ (n being a natural number).

"

As a result, Applicant's optimizable distance "D" controls the extent to which standing waves are propagated including delimiting the standing waves before they reach Applicant's plasma. As stated above, Otsubo teaches identical means and the Examiner believes that said relative positions and/or thickness of Otsubo's microwave radiating surface and Otsubo's plasma exciting surface that sustain Otsubo's standing wave is an optimizable quantity as taught by Otsubo. Further, it is well established that changes in apparatus dimensions are within the level of ordinary skill in the art.(Gardner v. TEC Systems, Inc. , 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied , 469 U.S. 830, 225 USPQ 232 (1984); In re Rose , 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); See MPEP 2144.04). Additionally, it is well established that the rearrangement of parts is considered

obvious to those of ordinary skill (In re Japikse , 181 F.2d 1019, 86 USPQ 70 (CCPA 1950); In re Kuhle , 526 F.2d 553, 188 USPQ 7 (CCPA 1975); Ex parte Chicago Rawhide Manufacturing Co. , 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984).; MPEP 2144.04)

8. Applicant states that none of the prior art teach a radial line slot antenna as "line-shaped slots.". In response, the Examiner directs Applicant's attention to Sato's slot antenna (41, Figure 2; column 9, lines 6-30) which has "line-shaped" slots 41. Only the ends of Sato's slots are "arc-shaped" as suggested by Applicant.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272.1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (703) 872-9306. Any

Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (571) 272-1439.

11/24/04